

# **A multi-objective algorithm for train driving energy reduction with multiple time targets**

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## **Abstract-**

Eco-driving is one of the most promising methods to reduce the energy consumption of existing railways. Considering the practical situation in complex railway lines, this article proposes a new multi-objective searching algorithm to obtain the set of most efficient speed profiles in train journey for each combination of arrival and intermediate times. This algorithm makes use of the particle swarm optimization principles. However, a criterion of minimum energy consumption for a combination of objective arrival and passing times is applied to avoid the gaps that could appear in Pareto fronts. The multi-dimensional set of speed profiles obtained by means of the proposed algorithm can help railway operators to make better decisions when designing timetables. In the simulation, variations of 25% can be observed in the energy consumption of two speed profiles with the same arrival time but with different passing times.

**Index Terms-** Energy efficiency, train simulation, eco-driving, multi-objective, particle swarm optimization

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